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PERSPECTIVES

Storm Damage Repair Requirements: Identifying Damage & Applying the Building Code

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OVERVIEW

When performing inspections of buildings or structures after a catastrophic event, such as a hurricane, several types of damage conditions may be encountered. The unpredictability of storms can present many challenges when determining how to repair a storm damaged structure. A few examples include:

- Identifying damage caused by the storm versus other, unrelated conditions (i.e. weathering, age related wear and tear, anticipated differential movements, improper construction, etc.).
- Understanding how to identify and navigate any Building Codes in effect including both state adoptions and local ordinances.
- Knowing which Building Code requirements are applicable for repairing the damaged structure.
- Identifying common mistakes or misinterpretations related to Building Code requirements.

Understanding the damage conditions and how to navigate and apply the respective codes for repairs are critical steps in achieving code compliance and returning the structure back to its pre-damage condition in a timely manner following a catastrophic event.

IDENTIFYING STORM RELATED DAMAGE VERSUS OTHER CONDITIONS

Assessing storm-related damage is an exercise of cause and effect. There are specific types of damage and failure modes that can be expected based on the storm conditions experienced in the geographic region. Flooding, fire, tornadoes, heavy rainfall, hail, high wind speeds, and storm surge are some of the various elements of a storm that pose a threat to structures. Researching the storm conditions (i.e. wind speed, hail size, rainfall amount, etc.) at or near the site as documented by a reliable source or obtaining weather reports can provide useful information.

Properly documenting the condition of the structure immediately following a storm is important as the subsequent actions are based on the information collected during this assessment stage. Often times damage can be documented (if safe to do so) through photographs taken right after the event. Depending on the situation, it may be prudent to engage the services of a building consultant and/or licensed design professional, such as a forensic engineer or architect, to inspect and document the observed damage as well as any reported conditions. While this may not always be feasible, thorough and timely documentation will be useful to a consultant or licensed design professional if they become involved at a later time.

Information related to the storm conditions as well as the nature and location of the damage can be assessed to parse storm-related damage from other unrelated conditions. These unrelated conditions can include defective construction such as improperly installed flashing or missing sealants. Other unrelated conditions can also include varying degrees of distress or deterioration which developed gradually over time as a part of natural and anticipated aging, wear and tear, and/or deferred maintenance. Another unrelated condition can be damage from a previous event not related to the most recent occurrence. Below is a list of some common types of storm damage and their associated trace evidence:

Possible Damage Caused by Flooding

- Saturated building components below an identifiable (high water) water line.
- Structural/foundation instability associated with scour or soil washout from fast moving water.
- Structural displacement due to hydrostatic forces (uplift or buoyancy) from standing water.

Possible Damage Caused By High Wind Speeds

- Damage or detachment of exterior finishes or cladding.
- Interior water damage due to storm-created openings or wind-borne projectiles in the building envelope.
- Structural instability or collapse due to movement of structural members and connections.

Other Conditions Commonly Misidentified as Storm Damage

- Cracks or separations due to normal and anticipated building movement such as thermal expansion or minor settlement.
- Interior water damage at pre-existing openings or improperly flashed or sealed joints.
- Windows or doors deemed compromised based solely on exposure to high wind speeds.
- Elevated moisture to substrates below roof or wall claddings due to pre-existing conditions or deferred maintenance.
- Corner chips or cracking of roof tiles due to stresses induced by shipment, installation, and/or foot traffic.

IDENTIFYING THE LOCAL BUILDING CODE

Once the extent of storm-related damage has been determined, the next step is to identify the building codes and requirements that are in effect for the local jurisdiction. Typically, any repair work performed to existing buildings is permitted and inspected at the local level. In some instances, state-level agencies may be involved for some licensed facility or specialized aspects of the project.

Generally, some version or derivative of the International Existing Building Code (IEBC) or rehabilitation code is in effect. In many instances, the state or local municipality will adopt an edition of the IEBC and make modifications intended to meet local needs. Therefore, the guidelines and requirements governing the repair of storm damaged structures may vary based on location. A certain number of states and even specific to some cities (New York City for example) have developed their own rehabilitation code that is used in placed of the International Existing Building Code. Some states or municipalities will publish the current building or rehabilitation codes in effect for their jurisdiction on their website. However, in some instances a phone call to the local Authority Having Jurisdiction (AHJ) may be required to confirm this information.

Another important consideration may be determining the date of construction and the original Building Code used for the structure. Generally, the original Building Code is that which was in place on the date the application was submitted to the local building department for original construction. In instances where the building was subsequently reconfigured or any major alterations were performed, the date the permit application was submitted for that work may determine the effective original Building Code. Identifying the original Building Code can help clarify the context of the structure's pre-storm configuration and provide insight on the necessity for code mandated upgrades if applicable.

APPLICATION OF THE BUILDING CODE FOR REPAIRS

> *2021 International Existing Building Code - Definition of repair*
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> *Repair: The reconstruction, replacement or renewal of any part of an existing building for the purpose of its maintenance or to correct damage.*

The IEBC International Existing Building Code provisions outline conditions under which repairs may be made using materials and methods like those used during original construction (e.g. put it back the way it was before the storm caused damage) or the extent to which repairs must comply with requirements for new buildings (e.g. repair work shall comply with current requirements to some degree). In any case, repairs to an existing building cannot make the building any less compliant than it was before the damage was sustained. Some key considerations to be aware of are presented throughout the balance of this section.

Figure 1 *- Visual Image of Exterior Structural Damage*

SSD & SD

An important consideration must be made in the understanding of the difference between Substantial Structural Damage (SSD) and Substantial Damage (SD)—also commonly known as the "50% Rule"—as it concerns the National Flood Insurance Program (NFIP). Substantial Structural Damage (SSD) as defined is solely related to the structural condition of the building. It has no relation to cost to repair or monetary value of damage.

In contrast, Substantial Damage (SD) is only related to the financial cost to repair structural and non-structural items including components related to interior finishes. It is based on the cost to do the work regardless of whether the work is considered structural damage or not.

While the two terms look similar, they are indeed different and have different applications in regard to how they are applied to a damaged structure.

Substantial Structural Damage (SSD)

An analysis will need to be performed to determine if the storm damage rises to the level of "substantial structural damage," as defined within Chapter 2, Section 202 of the International Existing Building Code. This analysis considers the extent of damage and the reduction in structural capacity and is typically performed by a licensed design professional. A brief overview of the required course of action required to make the determination of whether substantial structural damage has occurred is provided below. This evaluation is solely based on structural conditions with no incorporation of cost of work or threshold of financial repair costs

> *"In general, if it is found that the damage does not rise to the level of substantial structural damage, the structure can be restored to the pre-damage condition."*

> *"In general, if it is found that the damage does rise to the level of substantial structural damage, the structure will need to be restored to its original code with the potential for an increase in the original environmental design loads."*

Substantial Damage ("FEMA 50% Rule")

If the damaged building is located either partially or wholly within a Special Flood Hazard Area (SFHA) as defined by the Federal Emergency Management Agency (FEMA) flood maps, an analysis will need to be performed to determine if the criteria for "substantial damage" have been met. This applies to buildings damaged by any mechanism, including wind and fire, and is not limited to those damaged by flood. Substantial Damage (sometimes referred to as the "50% Rule") is defined within Chapter 2, Section 202 of the IEBC as:

> *"SUBSTANTIAL DAMAGE. Damage of any origin sustained by a structure whereby the cost of restoring the structure to its before-damaged condition would equal or exceed 50 percent of the market value of the structure before the damage occurred."*

Determine the Flood Zone and Required Elevation

To determine if the building is located in a flood hazard area, the applicable flood zone will need to be identified. The flood zone designation is established by FEMA and translated to local jurisdictions through the publication of Flood Insurance Rate Maps (FIRMs). Each municipality adopts rules established by FEMA, along with the FIRMs, to implement their flood protection plan. There are four types of flood zones as follows:

- Structures located within the **A Zone** (non-velocity zone) must be designed to be inhabitable after inundation of rising water with limited wave action of three feet or less.
- Structures located within the **Coastal A Zone** (non-velocity zone) must be designed to be inhabitable after inundation of rising water with wave action of one and a half to three feet.
- tructures located within the **V Zone** (velocity zone) are required to be able to withstand wave action greater than three feet in height.
- Structures located within the **X Zone** do not have any specific flood provision requirements.
- Structures located within the **X Zone (shaded)** are not subject to special flood provisions according to FEMA;

however, some jurisdictions are including this zone or specific types of structures within this zone as subject to the SFHA requirements by way of their local Floodplain Management Ordinance. If this has been done at the local level, some structures within this zone could be subject to the 50% Rule.

A FIRM is needed to determine in which flood zone a building is located. Digital versions of FIRMs can be found at the FEMA Map Service Center (https://msc.fema.gov/portal/home)

Substantial Damage should be considered for buildings located in any zone and then it should be determined whether the zone is identified as part of the SFHA by local ordinance or the FEMA maps. The local ordinance may also list the minimum flood elevation as well as any additional requirements such as freeboard, the additional elevation in height above Base Flood Elevation as required by the building code and sometimes having more stringent local requirements.. In addition, local amendments may exist, so it is advised that the applicable requirements be confirmed with the local building department or local floodplain management office.

Calculate the Repair Cost

When calculating the cost of repairs for a substantial damage determination, most expenses associated with the repair work should be included, such as labor, materials, finishes, fixtures, appliances, HVAC equipment, and the contractor overhead and profit. These values must be calculated at fair market value, even if the materials could be donated or the owners intend to perform the repair work themselves. Additionally, any work performed beyond the scope of required repairs such as owner elected changes, updates, or additions will be added to the cost. However, there are certain expenses that are not included in the calculation, such as costs to produce plans, specifications, surveys, building permit fees, costs for debris removal, items not considered to be permanently built-in or not physically attached to the structure in question, and costs associated with repairing pre-existing health or safety code violations identified by the local authority.

Determine te Market Value

The market value used for the substantial damage calculation only considers the structure and does not include land, landscaping, outbuildings, pools, driveways, or sidewalks. There are multiple methods that can be used to establish the market value of the structure. In some cases, the local authority will provide a formula that can be used to calculate the market value based on the value of the structure reported by the county property appraiser. Additionally, one can hire a licensed property appraiser to provide an accurate market value for the structure if the local authority cannot provide information on calculations or formulas to achieve a market value.

It is advisable to confirm with the local building department what they recognize as items to be included in both calculating the cost of the repair and the market value of the structure and, additionally, what documentation or proof will be required for each figure.

Determine Compliance with the Minumum Food Elevation

If substantial damage is triggered, the existing building must comply with the flood elevation requirements for new construction. An elevation certificate or survey is needed to determine if the building meets the minimum flood elevation requirement for its respective flood zone. Depending on the applicable zone, the lowest elevation of the finished floor level or the lowest horizontal member will need to be identified and compared to the minimum required flood elevation to determine compliance. This is determined by way of an Elevation Certificate (EC) which is performed on the structure. In some instances, an elevation survey can be found on file with the building department. Otherwise, a licensed surveyor or engineer may need to be engaged to complete an EC.

If the building is compliant, no additional work is required. If the building is not compliant, meaning it is in a flood hazard area and the lowest habitable space sits below the minimum flood elevation, it will have to be elevated or rebuilt to be brought into compliance with current flood elevation requirements. This can potentially result in costly code upgrades.

It is important to note that jurisdictions have the authority to enact into their ordinance a time frame associated with the 50% Rule such as all work needing to be performed within a given period of time (i.e. one year, 5 years, 10 years, etc.) They also have the authority to reduce the percentage threshold to one lower than 50%; however, this is not common. One should contact the AHJ or review the local flood ordinance for more guidance on this matter.

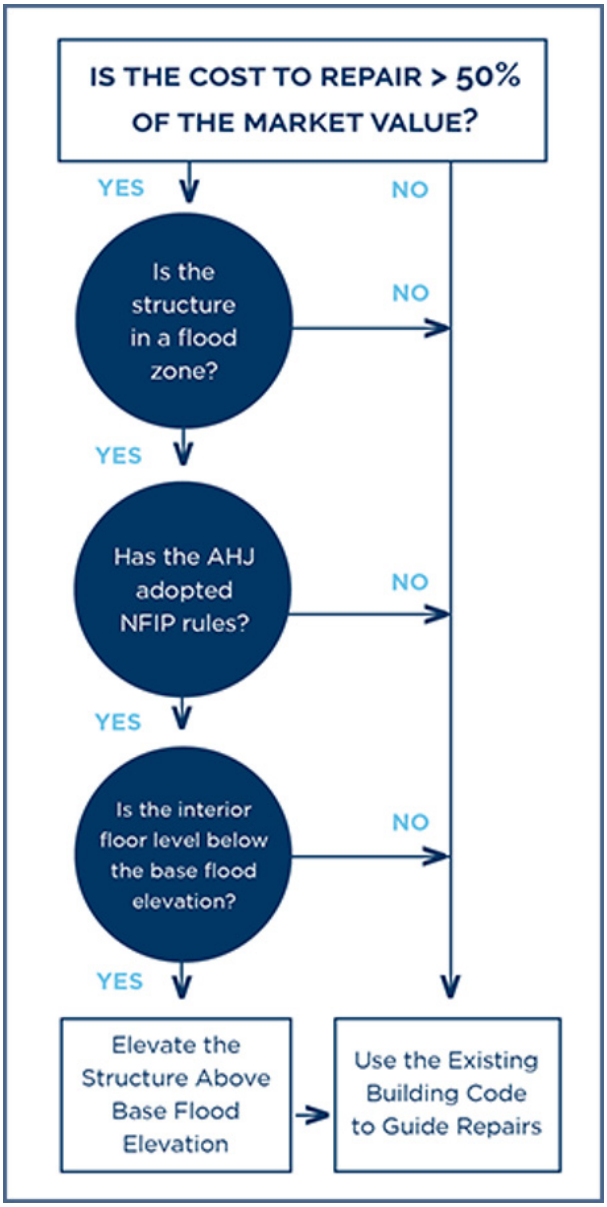

***Figure 2** - FIRM*

Window and Door Repairs

When damage occurs to openings in the building envelope, the 2021 International Existing Building Code Section 302.2 references that types of work performed shall comply with the applicable requirements of other ICC codes; International Building Code, International Energy Conservation Code, International Mechanical Code, and International Plumbing Code, as applicable. Section 302.4 provides guidance regarding the replacement of garage doors, exterior doors, skylights, and both operative and inoperative windows by stating that:

> *"Except as otherwise required or permitted by this code, materials permitted by the applicable code for new construction shall be used. Like materials shall be permitted for repairs and alterations, provided that unsafe conditions are not created. Hazardous materials shall not be used where the code for new construction would not permit their use in buildings of similar occupancy, purpose, and location."*

In other words, whole replacement window and door units must meet the current building code requirements which could include resistance to high wind loads or protection from debris impact, depending on the geographic location of the structure. However, the replacement of damaged windows or doors does not trigger the replacement of existing, undamaged windows or doors. Undamaged components are permitted to remain in place as they were prior to the storm event. Please note: some AHJ's have modified the adopted building codes and can require additional provisions beyond what the ICC family of codes require for these specific elements.

Protection of the new or replacement window and door openings are required when the structure is located within the "wind borne debris region." This area is typically one mile of the coastal mean high-water line where the design wind speed is 130 mph or greater or all areas where the design wind speed is 140 mph or greater. This determination is also based on the classification of the structure based on occupancy type with more critical usage of the building requiring opening protection at a lower threshold. Protection can be in the form of shutters or impact resistant glazing. On certain defined residential buildings such as single-family homes, the use of plywood or similar wood structural panels anchored to the structural framing surrounding the opening

can be accepted as a means of opening protection although this standard can vary by jurisdiction.

Roofing Repairs

In some instances, the extent of storm damage may include damaged roof shingles or other roof coverings. The International Existing Building Code identifies, in the Repair Chapter, the requirements for repairs to damaged elements. However, in the event of a full replacement or a roof recover, the International Existing Building Code provides additional requirements in the Alterations Chapter.

Some states or local jurisdictions may have additional requirements regarding repairs to roof systems. These additional requirements may instigate the full replacement of the roof covering depending on the extent of damage. Other requirements may include an increase in the required R-value for the roof insulation or additional mitigation measures such as the requirements for a secondary water barrier/sealed roof deck, enhanced roof deck fastening requirements, and even the installation of roof to wall connectors in structures located in higher wind areas that may not have had them installed at the time of original construction.

Figure 3 *- Visual Image of Damaged Roof*

Repairs to Historic Buildings

Within the Historic Buildings Chapter of the International Existing Building Code are the repair requirements for historic buildings. This chapter is of particular interest as it is the only chapter within the code that specifically addresses historic buildings and allows for flexibility in code compliance. There is the possibility that other state or local regulations exist related to historic structures so that should be researched before proceeding with any work on a historical building. With the approval of the local building official, alternative repairs can be made to preserve the character of historic buildings and protect the elements, spaces, and features that make these buildings historically or architecturally significant. However, the code still requires that whenever strict compliance is not achieved, the alternative must provide for equivalent protection and no hazard may be created or continued through noncompliance. The services of a registered architect or engineer is often required to perform evaluations and support the intent of alternative designs. The overall goal is to try to retain the historical context of the structure while following the guidance set forth as the code requires.

One important aspect to consider when trying to determine if a building is indeed historical is the criterion that the structure is accredited as having historic significance by a recognized federal, state, or local agency having authority to do so. A building merely being old does not automatically make it historic. One should contact the local or state historic preservation office (SHPO) for more information related to matters that deal with historic structures and their designation.

CONCLUSION

In the wake of a catastrophe, the primary goal is to return the damaged property to its pre-loss condition as quickly as possible while ensuring compliance with local building codes and requirements. Knowledge of the code related issues that may be present, an understanding of which code requirements are in effect in that affected area, and knowing how to navigate and apply the respective codes for repairs are critical steps in achieving code compliance and returning the structure back to its pre-damage condition in a timely manner.

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